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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/771,990	02/03/2004	Masahiko Furuno	09450/100K673-US2	3571
7278	7590	12/29/2006	EXAMINER	
DARBY & DARBY P.C.			ABOAGYE, MICHAEL	
P. O. BOX 5257			ART UNIT	
NEW YORK, NY 10150-5257			PAPER NUMBER	
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SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		12/29/2006	PAPER	

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

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<b>Office Action Summary</b>	<b>Application No.</b> 10/771,990	<b>Applicant(s)</b> FURUNO ET AL.	
	<b>Examiner</b> Michael Aboagye	<b>Art Unit</b> 1725	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 03 February 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 14- 28 and 41-48 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 14- 28 and 41-48 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☒ Certified copies of the priority documents have been received in Application No. 09/554,651.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 23-28 are rejected under 35 U.S.C. 112, second paragraph, as failing to set forth the subject matter which applicant(s) regard as their invention.

Regarding claim 23, It is unclear what the language calling for "applying the roughened surface of the soft solder alloy surface reforming treatment that calls for forming a layer containing fluorine on the surface of the soft solder alloy" means. The is rendered indefinite.

### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 14, 15, 17, and 20-22 are rejected under 35 U.S.C. 102(b) as being anticipated Pedder et al. (US Patent No. 5,000,819).

Regarding claim 14 Pedder et al. teaches an apparatus for forming a solder bump on a workpieces to be connected (flip chip components "9", see column 1, lines 15-19, figure and column 3, lines 48-51) including: a plasma generating means ("6", figure, and

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column 5, lines 45-50) adapted to generate at least hydrogen-containing plasma under a low pressure (column 3, lines 65-69 and column 4, lines 3-19); a gas supply means "7", (figure and column 3, lines 42-50) for feeding a process gas to the plasma generating means; a workpiece exposing means (the plate "2", see, column 3, lines 34-45) for exposing the solder alloy on the surface of the workpiece to the hydrogen-containing plasma (abstract and column 4, lines 10-19); and a heating means (electric heater platform "2", see column 3, lines 35-39) for supplying the heat input to cause the solder reflow ; wherein the reflow is conducted in a vacuum (column 3, lines 34-35).

Regarding claim 15, Pedder et al. teaches, a high frequency power supply (column 3, lines 44-46) and an electrode (the earthed shield formed of perforated plate "8"), (see column 3, lines 50-55, and column 4, lines 37-46). Regarding claim 15, the intended use of the instantly claimed apparatus is noted, however, the intended use does not patentably distinguish said claimed apparatus over the prior art. The intended use of the claims does not structurally limit the apparatus.

Regarding claim 17, Pedder et al. shows in the figure a gas recovery means (see figure, exhaust valve "11"), said gas recovery means disposed such that the workpiece is positioned between the gas recovery means and the gas supply; said gas recovery causes the plasma to flow between the source electrode and the workpiece (see figure, and column 4, lines 37-46).

Regarding claim 20, Pedder et al. teaches a high frequency power supply having a frequency of 2.45 GHz (column 3, lines 43-46).

Regarding claim 21, the apparatus of Pedder et al. is equally capable of generating a fluorine containing plasma. The intended use of the instantly claimed

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apparatus is noted, however, the intended use does not patentably distinguish said claimed apparatus over the prior art. The intended use of the claims does not structurally limit the apparatus.

Regarding claim 22, Pedder et al. teaches a movable platform "2", for positioning the workpiece and exposing the solder on the workpiece to the plasma (see, figure); an electric heater for generating heat for the solder reflow (column 4, lines 14-19).

5. Claims 23, 41, 43, and 46 are rejected under 35 U.S.C. 102(b) as being anticipated Todd (US Patent No. 5,139,193).

Regarding claims 23, 41 and 43, Todd teaches an apparatus and a method for forming a solder bump (column 1, lines 20-25) including: a surface roughening device having a mixture of hydrogen and an inert gas for roughening the surface of solder bumps formed on the surface of a workpiece (column 4, lines 43-49); a surface reforming device for performing surface reforming treatment step and forming a halogen containing layer including one of bromine, chlorine and fluorine on the roughened surface of the solder bumps (column 4, lines 34-42 and column 11, lines 58-64); a heating unit (reflow head "16", figure) operable to cause solder reflow to bond the workpieces together (column 3, lines 46-67, and column 6, lines 47-58).

### ***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 16 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pedder et al. (US Patent No. 5,000,819) in view of Panitz et al. (US Patent No. 5,409,543).

With respect to claims 16 and 18, Pedder et al. does not teach heating means that is provided with a light source adapted to heat the backside of the workpiece by radiation and a reflecting mirror for adjusting luminous flux from the light source.

However Panitz et al. teaches a device for dry solder reflow, having plasma charged vacuum chamber and heating means for solder reflow including ohmic resistive heaters, lasers, and inductive heaters (Panitz et al., column 4, lines 50-64). Note that conventional laser heating devices are equipped with mirrors and lenses for the purpose of focusing the radiant heat or light to maximizing and localizing the heat input on the target.

It would have been obvious to one of ordinary skill in the art at the time the applicant's invention was made to have used in the apparatus of Pedder et al. a laser heat source with adapted mirrors as taught by Panitz et al. since the ohmic resistive heaters and laser heaters are obvious alternatives known in the art (Panitz et al., column 4, lines 50-64)

8. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pedder et al. (US Patent No. 5,000,819) in view of Frei et al. (US Patent No. 5,345,056).

Regarding claim 19, Pedder et al. teaches a device for processing the surface of solder by using a gas mixture consisting of hydrogen and argon, but does not expressly teach the relative compositions of the elements in the mixture.

However, Frei et al. teaches solder processing by using a gas plasma mixture containing an inert gas and hydrogen gas with hydrogen content of between 5-15%. Said hydrogen content selected to ensure an appreciable reduction of the surface oxides to improve wetting (Frei et al., column 4, lines 44-53). Note the hydrogen content disclosed by Frei et al. depicts a range, which either overlap or lie inside the claimed ranges, however suitable hydrogen content can be achieved by optimization.

It would have been obvious to one of ordinary skill in the art at the time the applicant's invention was made to have used an optimum content of hydrogen in the gas plasma mixture in the apparatus of Pedder et al. in order to reduce the surface oxides and to improve wetting of the substrate by the solder (Frei et al., column 4, lines 44-53).

9. Claims 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Todd (US Patent No. 5,139,193) in view of Frei et al. (US Patent No. 5,345,056).

Regarding claims 24 and 25, Todd does not expressly teach either plasma roughening process or the relative compositions of the hydrogen/inert gas mixture.

However, Frei et al. teaches solder roughening by using a gas plasma mixture containing an inert gas and hydrogen, with hydrogen content of between 5-15%. Said hydrogen content selected to ensure an appreciable reduction of the surface oxides to improve wetting of the substrate by the solder (Frei et al., column 4, lines 44-53);

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wherein said plasma is able to generate chemical active species at low temperature thereby allowing the roughening process to be conducted at a low temperature (column 3, lines 49-62). Note the hydrogen content disclosed by Frei et al. depicts a range, which either overlap or lie inside the claimed ranges, however suitable hydrogen content can be achieved by optimization.

It would have been obvious to one of ordinary skill in the art at the time the applicant's invention was made to have used an optimum content of hydrogen in the gas plasma mixture in the apparatus of Todd in order to reduce the surface oxides and to improve wetting of the substrate by the solder (Frei et al., column 4, lines 44-53); and further to have used plasma roughening in the process of Todd in order to conduct the process at a lower temperature and thereby reduce the risk of damaging the electronic components being joined (column 3, lines 49-62).

10. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Todd (US Patent No. 5,139,193) in view of Frei et al. (US Patent No. 5,345,056) and Panitz et al. (US Patent No. 5,409,543).

Neither Todd nor Frei et al. teach argon as the applied inert gas.

However, Panitz et al. teaches a surface roughening process by using a plasma containing hydrogen and inert gas mixture; wherein the inert gas is one of nitrogen or argon (Panitz et al., column 5~~6~~, lines 39-49).

It would have been obvious to one of ordinary skill in the art at the time the applicant's invention was made to have used hydrogen /argon plasma in the process of Todd as modified by Frei et al. in view of the teachings of Panitz et al. since nitrogen



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and argon are obvious alternatives known in the art (Panitz et al., column 56, lines 39-49).

11. Claims 27, 28, 42, 44 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Todd (US Patent No. 5,139,193) in view Dishon et al. (US Patent No. 4,921,157).

Regarding claims 27, 28, 42, 44 and 47, Todd teaches a device and a method of surface roughening and surface reforming in separate steps (Todd, column 4, lines 43-49, column 34-42 and column 11, lines 58-64); said reforming treatment conducted by using a halogen; said halogen being one of bromine, chlorine and fluorine and forming a layer of said halogen on the previously roughened surface (Todd, column 34-42 and column 11, lines 58-64). Todd does not expressly teach either plasma reforming device and process, a plasma gas mixture of fluorine to which either one or both oxygen and argon are added or a fluorine compound consisting of at least one of the compounds selected from among carbon fluoride compounds, sulfur hexafluoride and nitrogen trifluoride.

However, Dishon et al. teaches a device for reforming a solder alloy on the surface of a workpiece by fluorinated plasma and forming a layer containing fluorine on the surface of the solder alloy (column 4, lines 40-49), and then heating to cause solder reflow (column 4, lines 50-68 and column 5, lines 5-16). Dishon et al also teaches oxygenated plasma as a means of removing organic residues (column 5, lines 49-61); Dishon et al. further teaches a fluorine compound consisting of at least one of the

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compounds selected from among carbon fluoride compounds, sulfur hexafluoride and nitrogen trifluoride (Dishon et al. , column 2, lines 5-10 and column 3, lines 7-15).

It would have been obvious to one of ordinary skill in the art at the time the applicant's invention was made to have used plasma to form the reactive fluxing atmosphere in the device of Todd during the reforming step as taught by Dishon et al. in order to reduce the temperature and the time for reducing the surface oxides and also avoid the risk of components damage due to higher operating temperatures (Dishon et al., column 3, lines 1-7 and lines 25-35; column 4, lines 20-34); furthermore enhance the removal of organic residues by oxygen plasma and thereby improve solder reflow and wetting (Dishon et al., column 5, lines 49-62) and to use fluorine compound to provide fluorine radicals in the reactive fluxing atmosphere (Dishon et al. , column 2, lines 5-10 and column 3, lines 7-15).

12. Claims 45 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Todd (US Patent No. 5,139,193) in view Dishon et al. (US Patent No. 4,921,157) and Ferriere et al. (US Patent No. 1,437,641).

Todd in view Dishon et al. do not expressly teach, a soldering apparatus operable in executing mechanical roughening.

However, Ferriere et al. teaches mechanical (or chemical) roughening (or cleaning ) as a means of improving solder adhesion (Ferriere et al. page 1, lines 57-60).

It would have been obvious to one of ordinary skill in the art at the time the applicant's invention was made to have conducted the cleaning or roughening in the device of Todd as modified by Dishon et al. by mechanical means in view of the

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teachings of Ferriere et al. since chemical and mechanical cleaning or roughening are obvious alternatives each of which promotes solder adhesion (Ferriere et al. page 1, lines 57-60).

### ***Conclusion***

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Egitto et al. (US 6,056,831), Ito et al. (US 5,054,421), Babbio et al. (US 5,499,754), Wakabayashi et al. (US 5,108,950) and Liedke et al. (US 5,192,582) are also cited in PTO-892.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Aboagye whose telephone number is 571-272-8165. The examiner can normally be reached on Mon - Fri 8:30am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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AM



Michael Aboagye  
Assistant Examiner  
Art Unit 1725

12/22/2006

KEVIN KERNS  
PRIMARY EXAMINER

Kevin Kerns 12/22/06